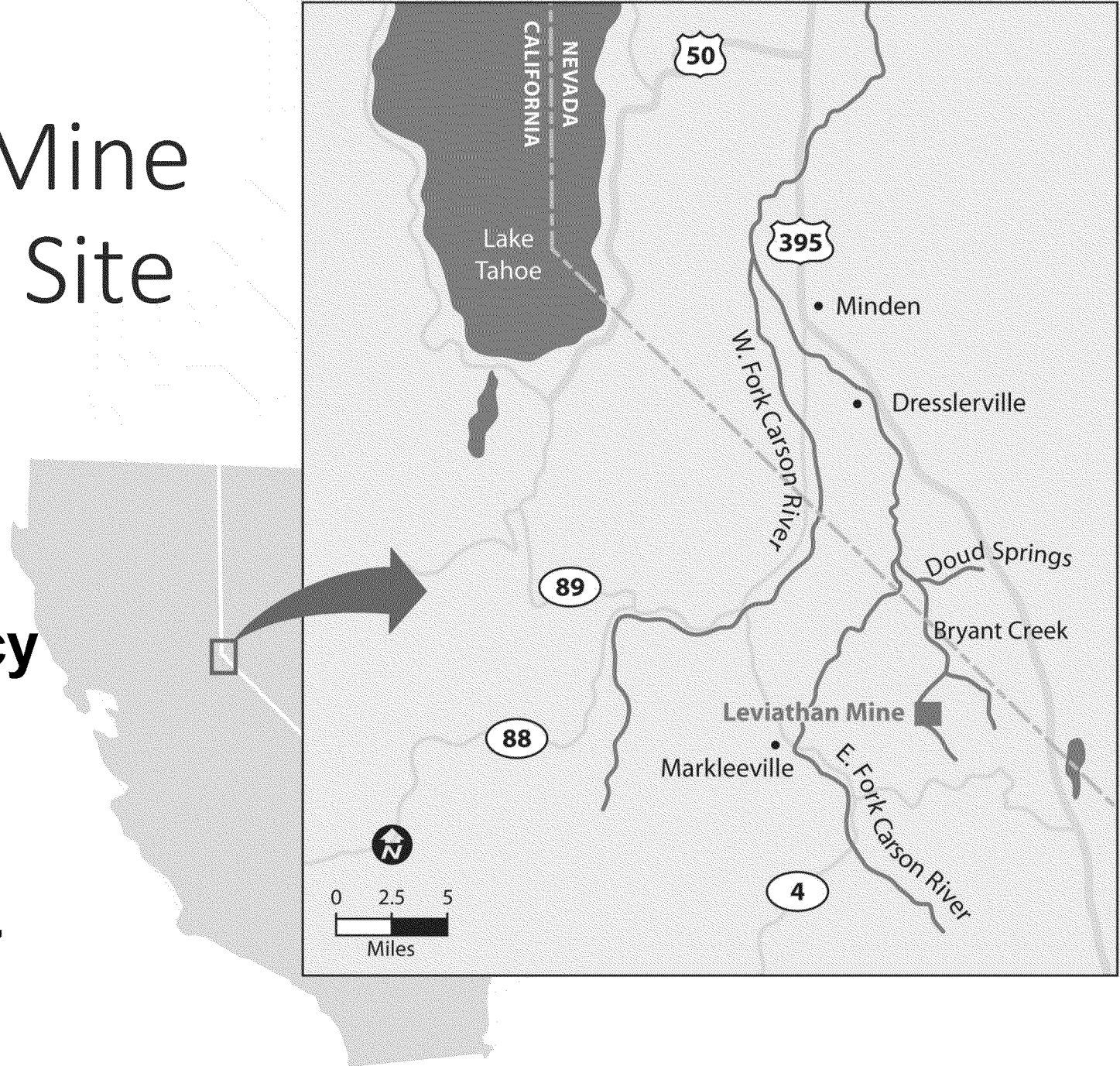


# Leviathan Mine Superfund Site

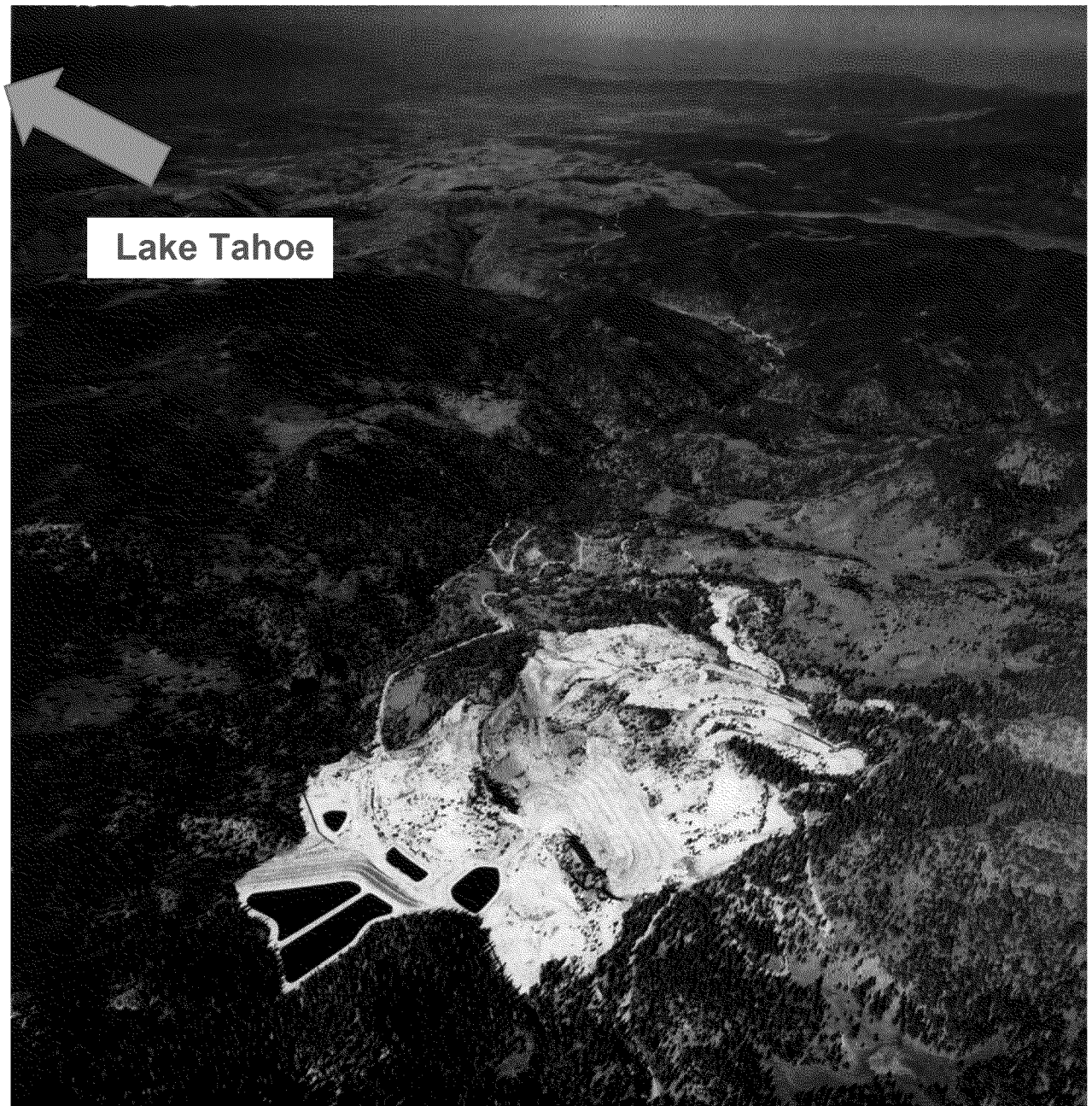
**U.S.  
Environmental  
Protection Agency  
Region 9**

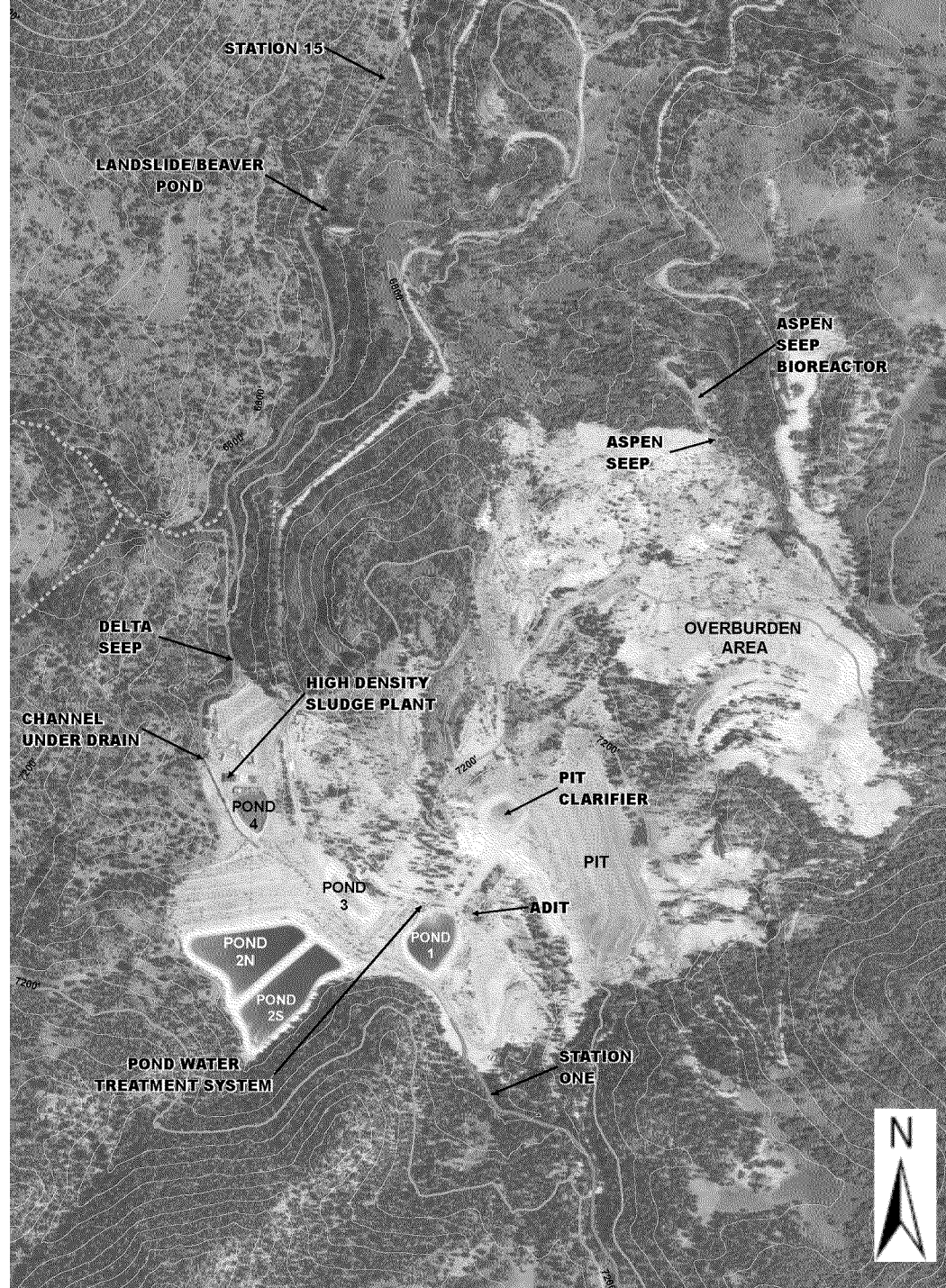
**March 2017**



# Leviathan Mine Alpine County, CA

- Abandoned open-pit sulfur mine. Listed on NPL 2000
- 24 Miles Southeast of Lake Tahoe
- Flows Northeast, to EFCR
- Impacts ~250 acres On site, ~750 acres Off site
- High elevation, limited access in winter
- Upstream from national forest, private, and Washoe land
- Interim Actions 80's;& Removal Actions still in place
- Remedial Investigation Ordered in 2008

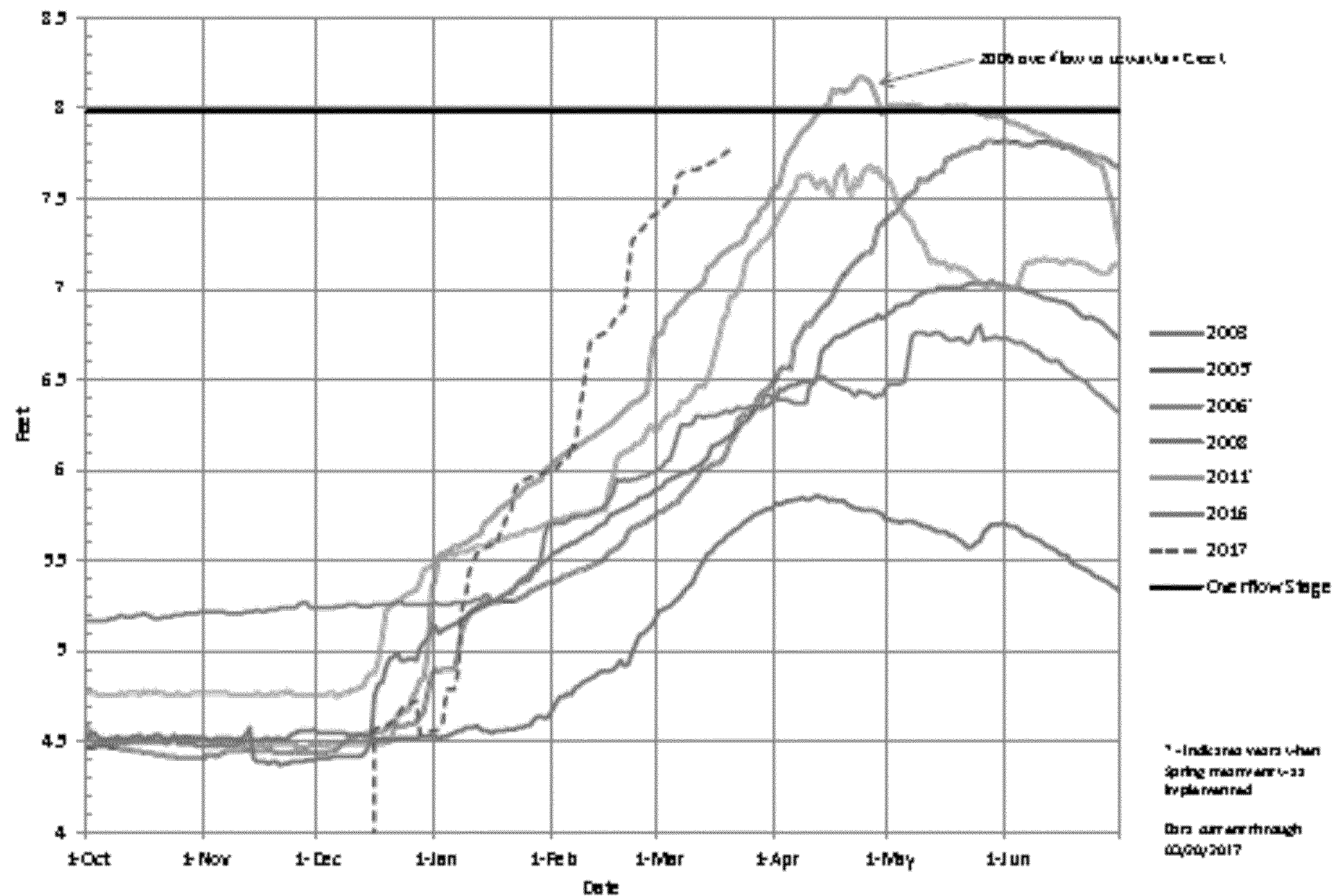




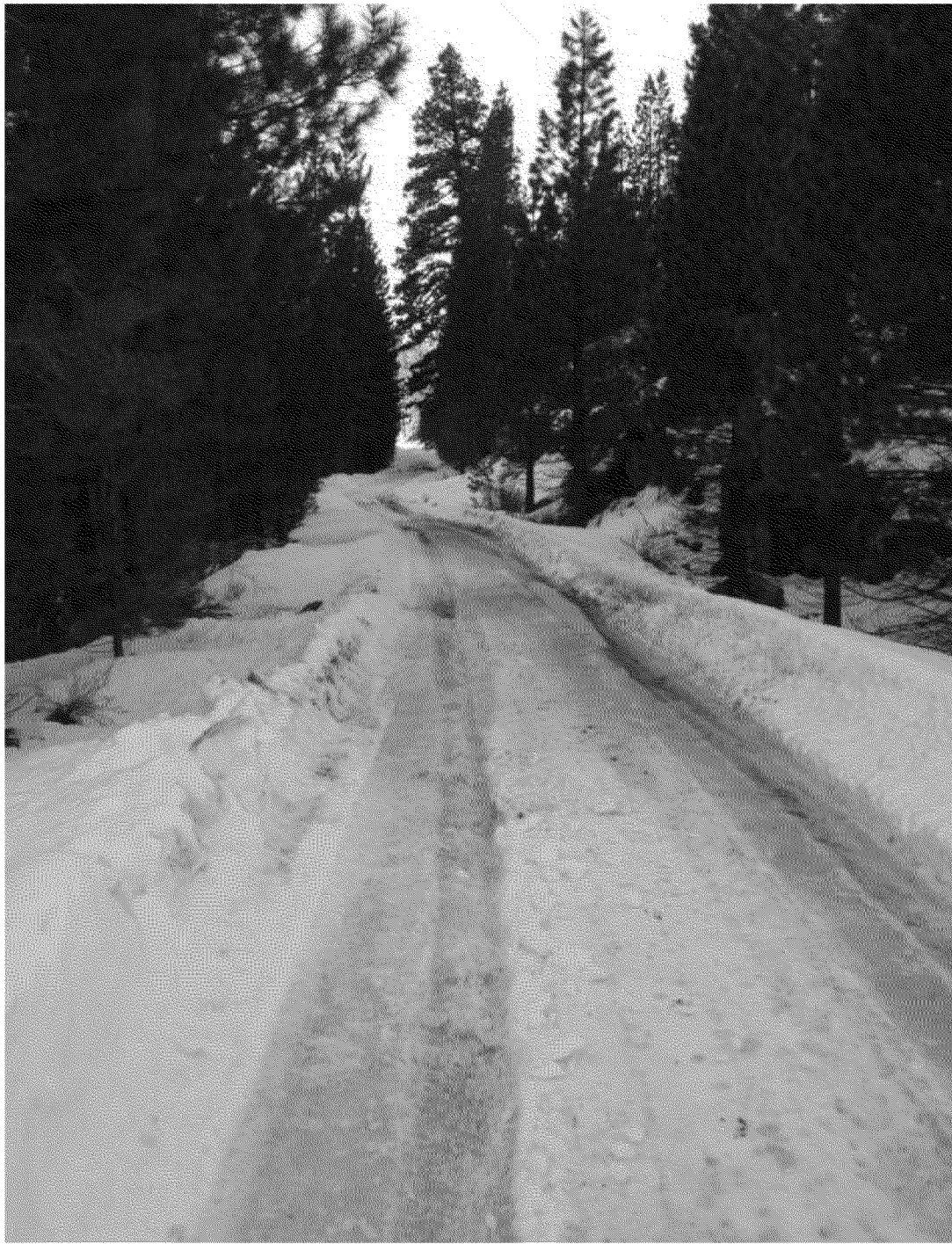
- Since 2001, most AMD captured and treated before discharge to Leviathan Creek during summer
- This annual seasonal treatment significantly improved downstream water quality in Leviathan Creek
- The HDS plant does not operate during the winter time, and the AMD from the CUD and Delta are not captured
- Storage Ponds collect water during the winter. Early spring treatment was used in 2005, 2006, and 2011.
- Early Spring Treatment using a similar portable process was initiated in March 3, 2011



# Figure 1 - Leviathan Mine Pond 1 Stage











<b>Table 1</b>			
<b>2017 Spring Treatment, Leviathan Mine</b>			
<b>Pond 3 Estimated Discharge Volume</b>			
<b>Date</b>	<b>Estimated Discharge Volume (gallons)</b>		
3/4/2017	380,000		
3/10/2017	430,000		
3/13/2017	326,000		
3/16/2017	430,000		
3/18/2017	467,000		
3/20/2017	394,000		
3/22/2017	429,000		
3/24/2017	371,000		
3/26/2014	399,000		
<b>Total Spring Treatment Discharge Volume</b>	<b>3,626,000</b>		



**Table 2**  
**2017 Spring Treatment, Leviathan Mine**  
**Untreated Pond Water Sample Results**

SAMPLE ID	Sample Description	SAMPLE DATE	pH	TEMP (°C)	Aluminum			Arsenic			Cadmium			Calcium			Chromium			Cobalt			Copper			Iron			Lead			Magnesium			Manganese			Nickel			Selenium			Sulfate (as SO <sub>4</sub> )			Total Dissolved Solids			Zinc		
USEPA Daily Maximum Discharge Criteria			6.0 - 9.0		4			0.34			0.009			NP			0.97			NP			0.026			2			0.136			NP			NP			0.84			NP			NP			NP			0.21		
USEPA 4-Day Average Discharge Criteria			NP		2			0.15			0.004			NP			0.31			NP			0.016			1			0.005			NP			NP			0.094			0.005			NP			NP			0.21		
					Result	DQ	EQ	Result	DQ	EQ	Result	DQ	EQ	Result	DQ	EQ	Result	DQ	EQ	Result	DQ	EQ	Result	DQ	EQ	Result	DQ	EQ	Result	DQ	EQ	Result	DQ	EQ	Result	DQ	EQ	Result	DQ	EQ	Result	DQ	EQ	Result	DQ	EQ	Result	DQ	EQ			
001P3001	Untreated water in Pond 3	2/24/2017	4.27	1.74	7.5	L		ND, 0.001			0.004			95.3			ND, 0.005			0.145	L		0.086			0.30			ND, 0.001			21.1			0.869			0.332			0.002			362	D		513			0.10		
001P1002	Untreated water in Pond 1	2/24/2017	3.05	0.09	36.2	D		0.188			0.004			90.4			0.075			0.22	D		0.127			36.3			ND, 0.001			7.6			1.24			0.577			0.001			587	D		789			0.13		
003P2S004	Untreated water in Pond 2 South	3/7/2017	2.23	0.30	98.7	D		0.894			0.009			53.2			0.236			0.550			0.341			147			ND, 0.001			12.5			2.99			1.47			0.002			1140	D		1680			0.29		
004P2S006	Untreated water in Pond 2 South	3/10/2017	2.69	0.0	67.9			0.403			0.007			39.8			0.170			0.425			0.253			88.7			ND, 0.001			10.3			2.20			1.12			0.003			868	D		1240			0.22		
006P2S008	Untreated water in Pond 2 South	3/14/2017	2.63	0.0	68.9	D		0.256			0.007			38.8			0.180			0.417			0.277			75.8			ND, 0.001			9.9			2.18			1.08			0.002			718	D		1110			0.20		
008P2S010	Untreated water in Pond 2 South	3/17/2017	2.50	0.0	40.9	L		0.06			0.004			23.6			0.087			0.223			0.148			36.3			ND, 0.001			5.8			1.18			0.582			ND, 0.001			450	D		644			0.12		
010P2S012	Untreated water in Pond 2 South	3/19/2017	2.59	0.0	30.8	L		0.035			0.003			17.0			0.064			0.171			0.118			24.5			ND, 0.001			4.4			0.877			0.442			0.002			342	D		469			0.09		
012P2S014	Untreated water in Pond 2 South	3/21/2016	2.36	0.0	22.3	L		0.027			0.002			14.0			0.045			0.123			0.085			17.5			ND, 0.001			3.1			0.649			0.318			ND, 0.001			245			351			0.06		
013P2S016*	Untreated water in Pond 2 South	3/22/2017	2.83	0.0																																																
014P2S018*	Untreated water in Pond 2 South	3/24/2017	3.03	0.0																																																
015P2S020*	Untreated water in Pond 2 South	3/26/2017	2.97	0.0																																																

All values reported in milligrams per liter (mg/L) except pH which are in Standard Units and temperature which are in the units specified above.

All parameters are dissolved except Selenium which is total recoverable.

All results are preliminary

NP - Not Promulgated

NA - Not Analyzed

\* - Analytical results pending

Sample result exceeds USEPA Daily Maximum Discharge Criteria

**Data Qualifiers (DQ) from the Laboratory:**

D - Analyte reporting limit increased due to sample matrix

L - Lowest available reporting limit for the analytical method used

ND - Not detected at the reporting limit, number following ND represents the reporting limit

Table 3  
2017 Spring Treatment, Leviathan Mine  
Pond 3 Discharge Sample Results

SAMPLE ID	Sample Description	SAMPLE DATE	pH	TEMP (°C)	Aluminum			Arsenic			Cadmium			Calcium			Chromium			Cobalt			Copper			Iron			Lead			Magnesium			Manganese			Nickel			Selenium			Sulfate (as SO <sub>4</sub> )			Total Dissolved Solids			Zinc																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																						
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Sample result exceeds USEPA Daily Maximum Discharge Criteria

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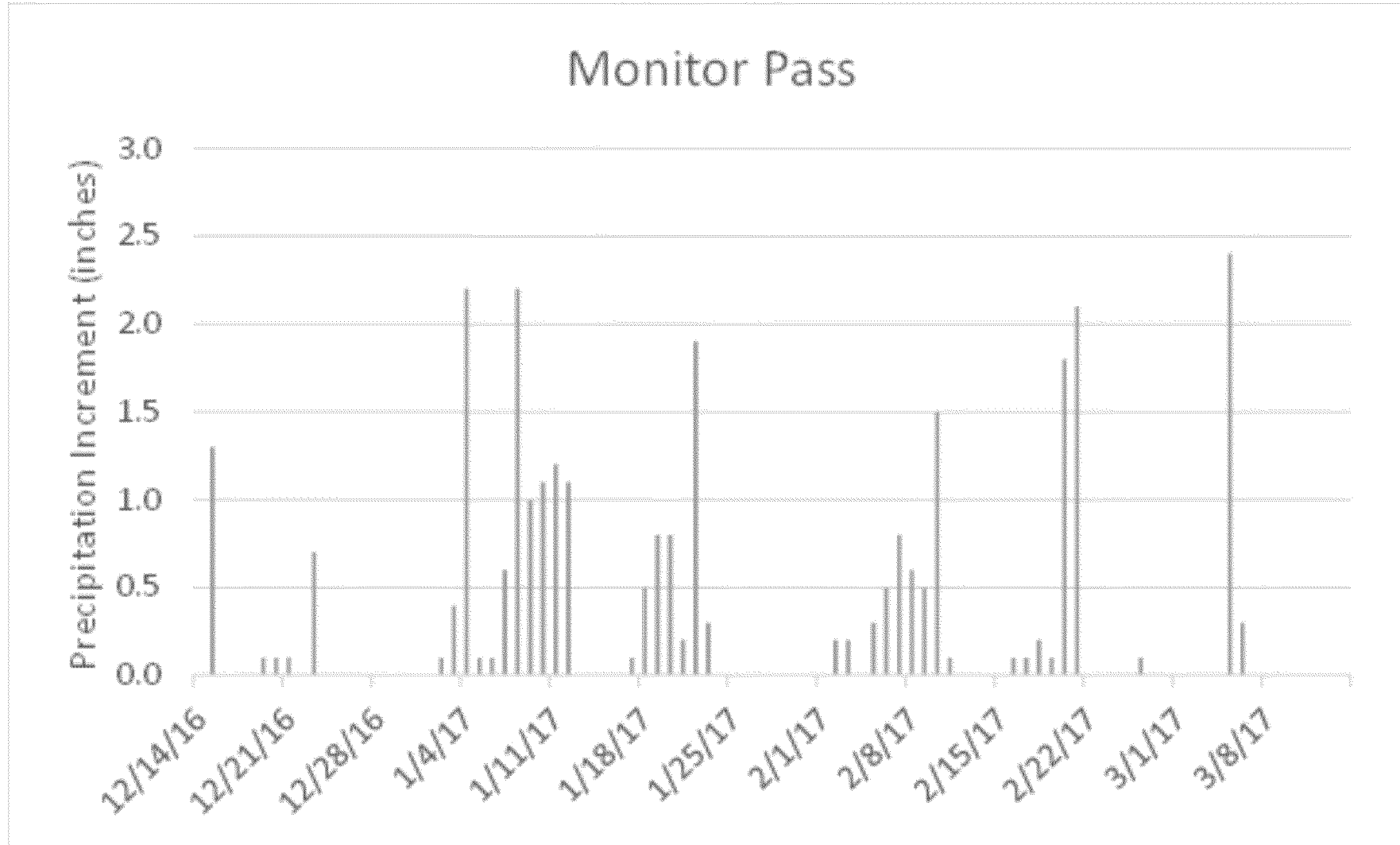
ND - Not detected at the reporting limit, number following ND represents the reporting limit

<b>Table 4</b>			
<b>2017 Spring Treatment, Leviathan Mine</b>			
<b>Manual Remaining Freeboard Measurements</b>			
<b>Date</b>	<b>Pond</b>	<b>Remaining Freeboard (ft)</b>	
3/9/2017	Pond 2 South	0.29	
3/20/2017	Pond 2 South	0.35	
3/22/2017	Pond 2 South	0.28	
3/23/2017	Pond 2 South	0.30	
3/27/2017	Pond 2 South	0.32	



# Precipitation Mid-December through Mid-March

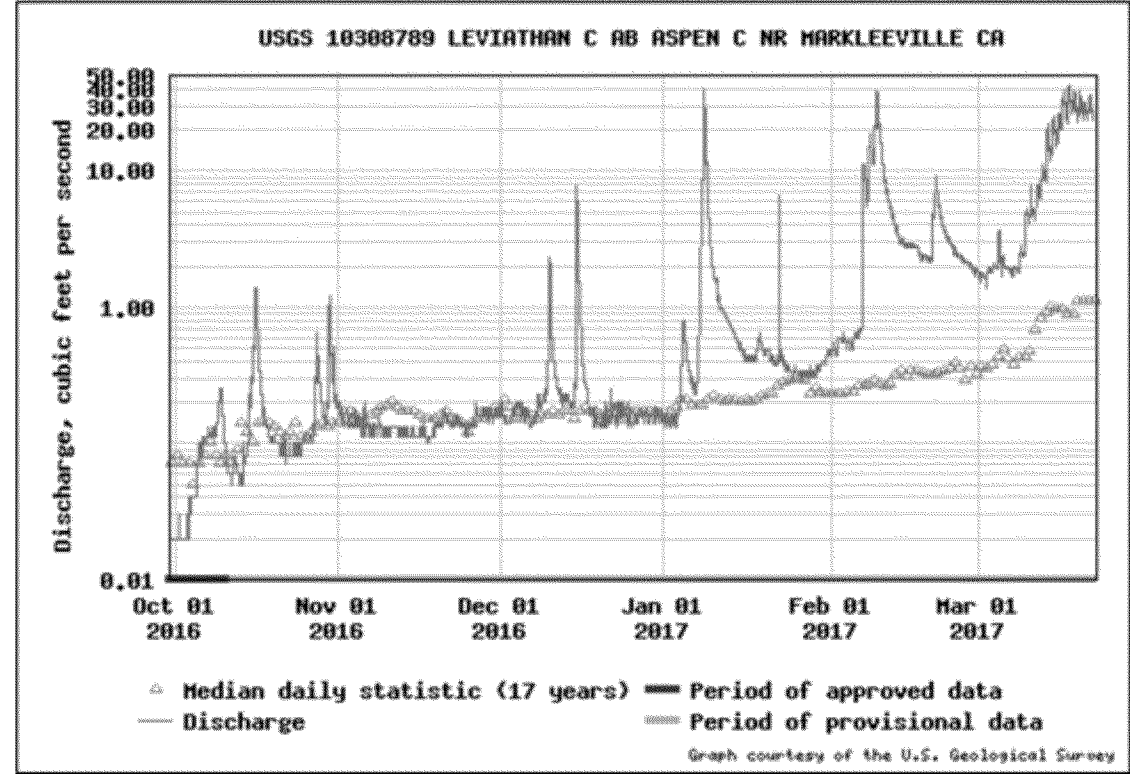
Precipitation measured by the Monitor Pass SNOTEL station for the last three months (December 13, 2016 – March 13, 2014) shows that daily incremental precipitation exceeded 1 inch on 12 days. The highest daily incremental precipitation, 2.4 inches, occurred on March 5.



Streamflow and Water Quality Mid-December through Mid-March

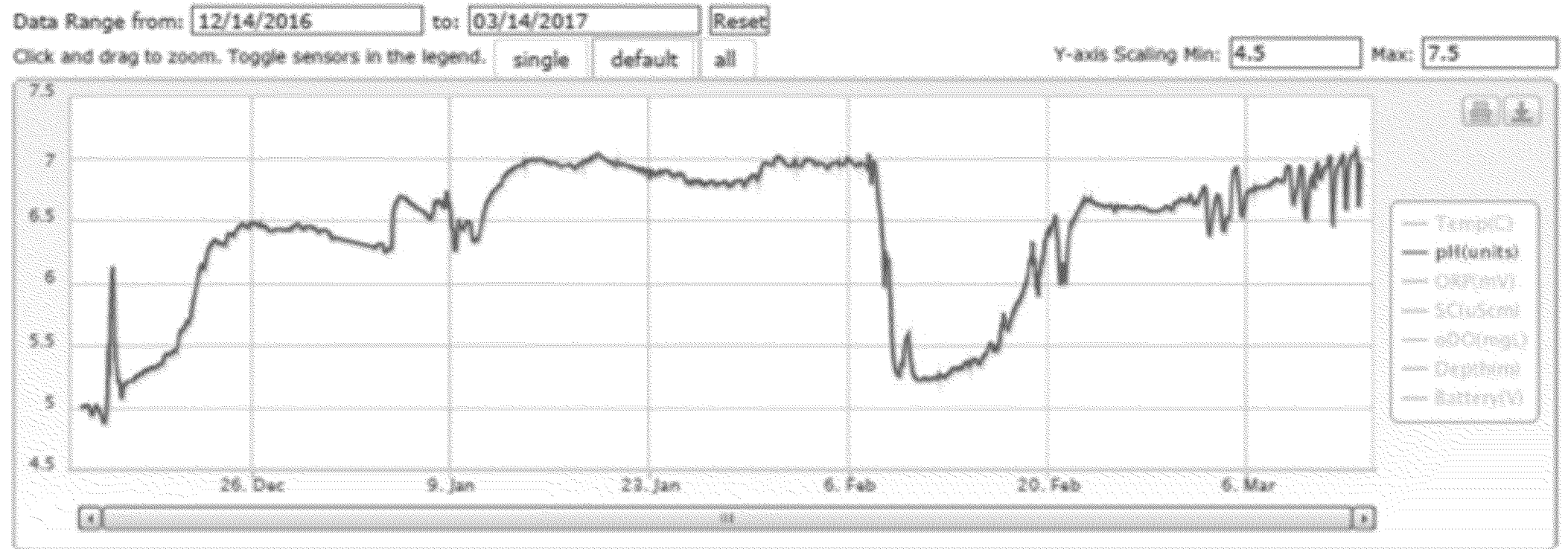
Streamflow in Leviathan Creek is measured at Station 15, the USGS gaging station downstream of the beaver dam/pond complex but upstream of the confluence with Aspen Creek. Periods of elevated streamflow generally followed precipitation events, but streamflow is not proportional to precipitation. Precipitation can fall as rain or snow. Rain, particularly rain on snow, causes greater streamflow than does snow. Streamflow can also be produced by snowmelt during periods of no precipitation. The most recent period in which streamflow increased from about 2 cfs to about 40 cfs appears to be caused by snowmelt. Precipitation was not measured at Monitor Pass March 7-20, yet streamflow increased throughout this period, reaching a maximum value of 42 cfs on March 17. This is the second largest value observed at this site since measurement began in 1999. The largest measured streamflow is 68 cfs. There is also a diurnal pattern with streamflow generally increasing during the day and declining during the night, which is characteristic of snowmelt. Although treated pond water may have been discharged in late February or early March, the discharge would be small relative to the total measured flowrate. As a point of reference, 100 gallons per minute is approximately 0.2 cfs.

The measured streamflow was greater than the median flowrate throughout most of this period.



The largest flow event, 68 cfs (30,500 gpm) was measured December 31, 006. Streamflow from snowmelt in March 2017 reached approximately 40 cfs March 16-19, and the second largest recorded flow of 42 cfs (19,000 gpm) occurred on March 17. Other recent peak flows occurred January 8, 2017 (40 cfs; 18,000 gpm) and February 9-10 (38 cfs, 17,000 gpm).

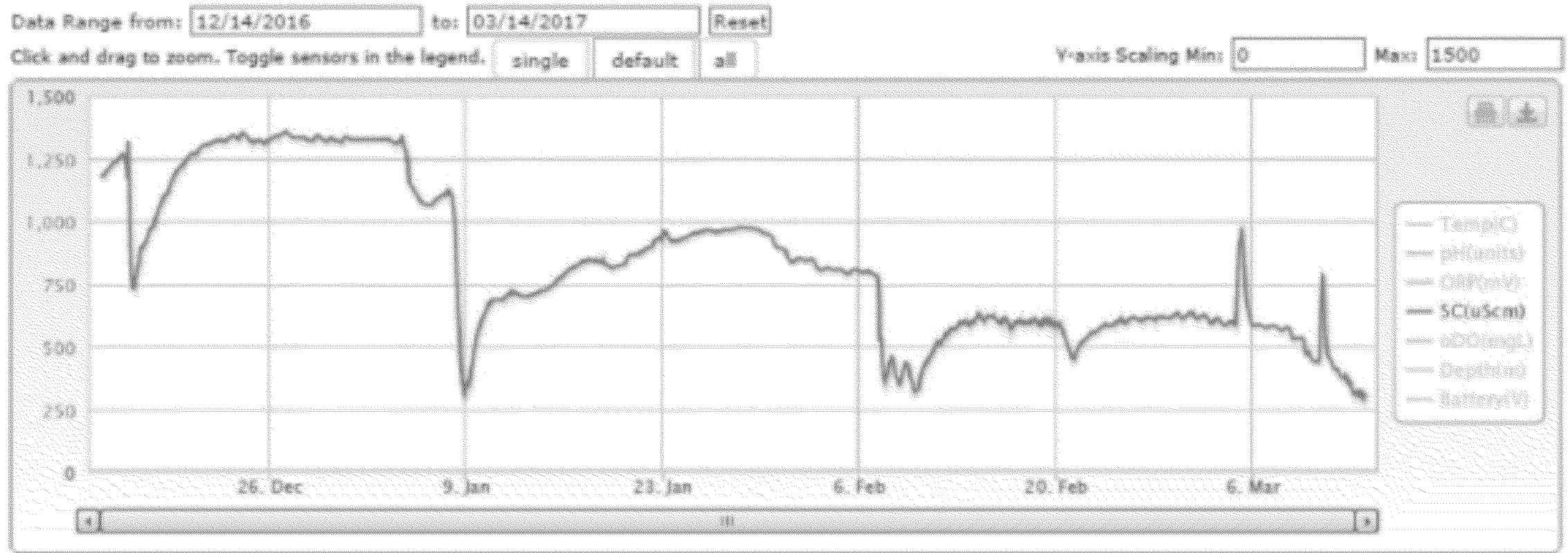
pH variations during this period are more complicated than the SC variations. During mid-December, pH gradually increased from about 5 to 6.5 standard units and had a short term increase to about 6.1 associated with the December flow event during this gradual increase. pH was relatively stable at approximately 6.3 to 6.5 until the flow event the week of December 31. During the flow events that occurred the weeks of December 31 and January 7, pH increased from about 6.3 to 6.7, and then declined and fluctuated between about 6.3 and 6.5. pH increased from about 6.3 on January 11 to 7.0 on January 14 and remained fairly constant at 6.8 to 7.0 until February 7, then declined to about 5.3 on February 9 during a high flow event, increased to approximately 6.5 on February, and fluctuated between 6.4 and 7.0 through March 13.





## Water Quality

Water quality parameters specific conductance (SC) and pH (as well as other parameters) are measured by U.S. EPA's water quality monitor adjacent to the streamflow station. SC declined abruptly during periods of high streamflow, and was relatively stable between high flow events. The cause of the short term spikes in SC March 5 and March 10 has not been identified.



# Contingency and Monitoring Plan

Both ARC and Waterboard conduct a monthly site visit. During each event, field observations indicated that adequate pond storage was available, and there was no indication of beaver dam failure or restriction of the Leviathan Creek Culvert.



Photograph 6: Leviathan Creek Culvert Looking Downstream

	ARC visits	RWQCB Visits
	December 2, 2016 January 6, 2017 February 1, 2017 March 2017, TBC	January 17, 2017 February 14 , 2017 February 26, 2017 March or early April, 2017 TBC

# ARC Oversight Early Response Actions

	Aspen Seep Bioreactor	HDS Plant
	<p>Increase in flow through the ASB Treatment System; higher flows are expected during most of 2017</p> <ul style="list-style-type: none"> <li>--More consumables (Ethanol, NaOH, and propane)</li> <li>--Remote monitoring adjust chemical dosing for changing flow rates</li> <li>--Access via snowmobiles</li> <li>--Increased flows do not appear to affecting operating effectiveness.</li> <li>--Continue to monitor for system effectiveness</li> </ul>	<p>HDS does not operate during the winter months</p> <ul style="list-style-type: none"> <li>--Increased flow rates of CUD and DS</li> <li>--Higher than average initial volume of Pond 4</li> <li>---Increased use of consumables (lime, flocculant, diesel, fresh water).</li> <li>--Site access/ treatment season could be limited</li> </ul>



# EPA Contact Information

EPA's Superfund Toll-Free telephone number 1-800-231-3075

Lynda Deschambault (415) 947-4183  
[deschambault.lynda@epa.gov](mailto:deschambault.lynda@epa.gov)

EPA's Web page: [www.epa.gov/region09/LeviathanMineSite](http://www.epa.gov/region09/LeviathanMineSite)

## Information Repositories

**Douglas County Library**  
1625 Library Lane  
Minden, NV 89432  
(775) 782-9841

**EPA Superfund Records Center**  
75 Hawthorne Street (3rd Floor)  
San Francisco, CA 94105  
(415) 536-2000